transmits large waves with a constant velocity. In the case of the Californian earthquake, which originated on fault lines on the western side of that country, I should imagine the reflecting surface to be the Sierras, 200 miles distant. The wave group would travel to these mountains and back in about four minutes, and this is approximately the time interval between the two first large wave groups in seismograms I have of that disturbance. After the first echo or echoes, an earthquake usually dies out as a series of surgings which frequently have a striking similarity to each other. One explanation of these rhythmical recurring groups is that they simply represent times when the movement of the ground has synchronised with the natural period of the recording instrument. Although the terminal vibrations seen on a seismogram may be attributed to this cause, it does not exclude the idea that rhythmical beats at an origin may result in rhythmical responses at a distance.

Side-issues of seismology are quite as instructive as the information we derive from the records of earthquakes. We have already referred to light effects which accompany large earthquakes. This, as we have seen, led up to investigations connected with micro-organisms. A long series of experiments, which commenced in Japan and were continued in the Isle of Wight, involved a series of investigations bearing upon the transpiration of plants. The fundamental object of these experiments was to determine whether valleys always retained the same form. Did they open and shut? To answer the question I set up on the two sides of a valley horizontal pendulums identical with those which are used to record teleseismic motion. These instruments, which are by photographic means self-recording, are exceedingly sensitive to small changes in level. What I found was that on fine days the booms of these instruments moved in opposite directions, each away from the bed of the valley. At night the motions were reversed, and the booms moved towards each other, that is, towards the bottom of the valley. Several instruments were employed, and the records were confirmed by the movements of the bubbles of sensitive levels. During the day the records indicated that the sides of the valley opened, and at night they closed. The two valleys I worked upon behaved like ordinary flowers, they opened when the sun was shining and closed at night. The best explanation I can offer is that the phenomenon is largely dependent upon the transpiration of plants. This is marked during the day, but not at night. On a bright day a sunflower or a cabbage may discharge 2 lb. of aqueous vapour. A square yard of grass will give off 10 lb. or 12 lb. The result of this is that during the day underground drainage has not received its full supply of water to load the bottom of the valley. At night time, when plants' transpiration is reduced, subsurface drainage is increased, and the load at the bottom of the valley is also increased. Therefore, at night the bottom of a valley, in consequence of its increased water load, is depressed, and this is accompanied by a closing of its sides. During the day the load runs off, and the valley opens. This may also explain why soak wells in valleys and streams carry less water during the day than they do at night, and at the same time it suggests that the side of a valley is a bad place for an observatory. Every day as the world turns before the sun, lamp-posts and tall structures salute the same, whilst many valleys open. At night time these movements are reversed.

One phenomenon which accompanies all large earthquakes, which, however, has never yet received the attention it deserves, is the influence which great disasters have exercised upon the emotions. Immediately after the Kingston earthquake, we read of the dazed and almost insane condition of the people. Many were affected with an outburst of religious ecstasy, thinking the last day had come. The negro population camped on the racecourse, and spent their time in singing hymns. Somewhat similar scenes took place in Chili; men and women ran hither and thither, mad with terror and devoid of reason. Amid shrieks and sobs, and the wailing of a multitude, an "Ora pro Nobis" or a "Pater Noster" might now and then be heard. In early civilisations underground thunderings have so far excited the imagination that subterranean monsters or personages have been conjured into existence, and these in many instances have played a part in primitive religions. At the time of an earthquake in Japan, the children are told that the shaking is due to the movement of a fish which is buried beneath their country, and in Japan we find references to this fish in the pictorial art, glyptic art, literature, and everyday conversation, all of which would be unintelligible if we did not know the story of the earthquake fish. In other countries the subterranean creature will be a pig, a tortoise, an elephant, or some other animal. The most interesting myths, however, relate to underground personages. The forty-five Grecian Titans, who were of gigantic stature and of proportionate strength, were confined in the bowels of the earth. According to the poets, the flames of Etna proceeded from the breath of Enceladus, and when he turned his weary side the whole island of Sicily was shaken to its foundations. Neptune was not only a god of the oceans, rivers, and fountains, but with a blow of his trident he could create earthquakes at pleasure. The worship of Neptune was established in almost every part of the Grecian world. The Livians, in particular, venerated him, and looked upon him as the first and greatest of the gods. The Palici were born in the bowels of the earth, and were worshipped with great ceremonies by the Sicilians. In a superstitious age the altars of the Palici were stained with the blood of human sacrifices. In Roman mythology, two very familiar deities are Pluto and Vulcan. These and a host of other deities, the outcome of imagination, excited by displays of seismic and volcanic activity, we meet with every day in picture galleries, in museums, in literature, and in our daily papers. The fact that we are enjoined not to make any graven image of that which is in the earth beneath suggests that in the time of Moses a certain form of worship called for some correction. Over and above adding a clause to the decalogue, large earthquakes have in very many ways affected religions. After the earthquake which shook England on April 6, 1580, the then Archbishop of Canterbury drew up a form of prayer which was approved by the Privy Council, and ordered by them to be read in all dioceses in the kingdom. In the world there are many instances of religious services being held on the anniversary of an earthquake, it being regarded as an exhibition of God's vengeance upon a wicked people. The belief that earthquakes are signs or warnings owes its origin in part to prophecies in the Bible, where, for example, we read that "there shall be famines and pestilences and earthquakes" as portending future calamities. Earthquakes have led to the abolition of oppressive taxation, the abolition of masquerades, the closing of theatres, and even to the alteration in fashions. A New England paper, of 1727, tells us that "a considerable town in this province has been so far awakened by the awful providence in the earthquake that the women have generally laid aside their hooped petticoats."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

The success of the Children's Museum in Bedford Park, Brooklyn, as a factor in education forms the subject of an article by Miss A. B. Gallup in the April number of the *Popular Science Monthly*. At its commencement in 1899 the museum comprised only two rooms, containing little more than a few insects, shells, and stuffed birds. The eagerness with which these were visited by children soon led, however, to extension, and twelve exhibition rooms, furnished with specimens, models, and pictures illustrative of nearly every subject interesting to childhood, are now open to the public. These collections illustrate the chief branches of natural history, geography, art, and the history of the United States. Young people are encouraged to think and act for themselves, one result being the installation of a wireless telegraph apparatus by a party of boy visitors, some of the members of which subsequently obtained appointments as wireless telegraphists. The institution seems worthy of imitation in this country.

Dr. W. E. Hoyle, director of the Manchester Museum, speaking on children's museums at a museum conference

© 1908 Nature Publishing Group

held at Preston on April 11, remarked, in reference to the American institutions of this kind, that in the one at Brooklyn the following aims have been kept in view:—(1) to employ objects attractive and interesting to children, and at the same time helpful to teachers in every branch of nature-study; (2) to secure an arrangement at once pleasing to the eye, expressive of fundamental truth; (3) to avoid confusion from the use of too many specimens, and the consequent close crowding in cases; (4) to label with brief descriptions, expressed in simple language and printed in clear, legible type. The keeping of live animals is an important branch of the work, and a source of endless interest to the young visitors. A striking exhibit is a series of historic models illustrating the six chief types of people who formed permanent settlements in North America.

A scheme is under consideration for the establishment of a university in Hong Kong. Mr. Mody has placed at the disposal of Sir Frederick Lugard, the Governor of Hong Kong, a sum of 15,000*l.* for the purpose. At a recent meeting, according to Reuter's agent, Sir Frederick Lugard said he is willing to recommend the Government to provide a site, but cannot go further than that in view of the liabilities of the Government. He believes that if Hong Kong could establish a university with facilities equal or superior to those at Tokio, it would attract a large number of the wealthy Chinese students who now go to Japan, America, and Europe, and would increase the prestige and influence of Great Britain throughout the Chinese Empire. To provide an adequate endowment for even the modest beginning proposed, a sum of not much less than 100,000*l.* will be required.

The treasurer of University College, Bristol, has received a donation of 550*l.* from the University College Colston Society for general purposes, and a grant of 50*l.* from the Board of Agriculture to enable the department of economic biology to carry on its investigations on the effect of electricity on plants. The County Council of Somerset has approved a scheme of research in connection with Cheddar cheese-making, and has authorised an expenditure of 200*l.* for the first year on this work. The Gloucestershire County Council has passed the following resolution in support of the movement for the establishment of a university in Bristol:—"That this council approves of the scheme for promoting the Bristol University, and will consider what, if any, financial assistance they can accord to it when the scheme is more fully developed."

In an address at the graduation ceremony of the University of Edinburgh on April 10, Prof. Chrystal referred to reforms in secondary and university education in Scotland. In 1886 Prof. Chrystal placed before the Scotch Education Department a scheme for a general leaving certificate examination for schools. The department approved the suggestion, and Sir Henry Craik carried out the scheme in detail with very satisfactory results. Prof. Chrystal now proposes to make the Scotch Leaving Certificate examination the normal course of entrance to each university, and to abolish the university preliminary examination. Already the leaving certificate examination is accepted by Scotch universities in lieu of the preliminary examination for the subjects it covers, and it is desirable to make the examination a complete passport to the universities. Part of Prof. Chrystal's original proposal to the Scotch Education Department regarding the leaving certificate was the creation of a National Board of Surveillance, on which the department, the schools, the universities, and certain other public bodies were to be represented. His object was to avoid the necessity for the institution of a university preliminary examination. A generally accepted standard for entrance to the University is an inevitable element in university reform; but the administration of a general leaving examination for schools is not the proper business of the universities. No doubt one of the functions of a leaving certificate should be to qualify for an academic course, but it has many other functions besides, and all that the universities should claim is a share in the surveillance of the leaving certificate in so far as it concerns them. Prof. Chrystal went on to say that the advance of secondary education, in particular the opening of junior student centres all over Scotland, is rapidly preparing the way, if it has not already prepared it, for carrying out the ideal of the Universities Commissioners. "I turn, therefore, with renewed hope and renewed insistence to the men of wisdom and of influence, who hold in their hands our educational destiny, and ask them to consider once more my old proposal for a National Board, which shall regulate the schools' leaving certificate, so that it shall become the normal portal of admission to the universities, and render the present preliminary examination and the present Joint Board and all its works unnecessary. This reform must, of course, be taken up as a national affair. It is no matter of the autonomy of the universities. It concerns the welfare and good government of all the secondary schools of the country; also, I may say, the relation of our standards of secondary education to similar standards all over the British Empire."

SOCIETIES AND ACADEMIES.

London.

Linnean Society, April 2.—Lieut.-Colonel Prain, F.R.S., vice-president, in the chair.—The anatomy of some sapotaceous seedlings: Winifred **Smith.** The seedlings of the Sapotaceæ are remarkable on account of (1) their exceptional mode of transition from root to stem; (2) the lack of continuity in the different parts of the vascular system; (3) their tendency to a geophilous habit. To Dangeard's axiom:—"Le plan vertical médian des cotylédons correspond toujours à un faisceau vasculaire de la racine," the sole exceptions vouched for are trees, and occur in the Sapotaceæ and in two genera of the Fagaceæ.—Notes on some sponges recently collected in Scotland: Dr. N. **Annandale.**

Society of Chemical Industry (London Section), April 6.—Dr. Lewkowitsch in the chair.—Considerations affecting the "strength" of wheat flours: Julian L. **Baker** and H. F. E. **Hulton.** It is improbable that any one chemical or physical determination can be used for determining the "strength" of flours, as the generally accepted definition includes two distinct qualities, viz. size and shape of loaf. It is recommended that bakers should apportion marks independently for size and shape. A proteolytic enzyme capable of degrading the gluten, and so influencing the character of the loaf, appears to be absent, but there is a small quantity of an erepsin. Yeast enzymes can effect partial proteolysis of gluten. Aqueous flour extracts depart from Kjeldahl's law of proportionality. Maltose is the sole sugar formed during doughing. Flours on keeping display changes in enzymic activity. Doughs have a greater diastatic activity than either the aqueous extract of the flour or the flour itself, and this activity varies inversely with the amount of water present. Flours contain a starch-liquefying enzyme, and this enzyme is closely connected with gas production. The formation of gluten from gliadin and glutenin is independent of enzymic activity, and is probably only a hydration phenomenon. Gliadin separated from flour was re-combined with the residual gluten and starch, and the gluten, in a weakened condition, was recovered by washing out. The diastatic activity of gluten is confirmed, and shown to reside in the glutenin moiety.—The occurrence of cyanogenetic glucosides in feeding stuffs: T. A. **Henry** and S. J. M. **Auld.** In association with Prof. Dunstan, the authors have investigated a number of plants which yield prussic acid when in contact with water, and show that the prussic acid is formed by the interaction of a glucoside and an enzyme which decomposes it, liberating prussic acid. Several of these plants are employed as feeding stuffs, notably Java beans, and it is to this liberation of prussic acid that the numerous cases of poisoning of cattle by these beans are due. Linseed cake also contains a cyanogenetic glucoside, but the high temperature to which the cake is heated in the course of manufacture destroys the enzyme originally present in the seed. The seed of the Para rubber tree, sometimes used for feeding purposes in the tropics, also yields small quantities of prussic acid.—Note on murexide as a quondam dye-stuff and printing colour: Watson **Smith.** The author exhibited a specimen

© 1908 Nature Publishing Group